

The Office of Environment, Safety and Health and its Office of Nuclear and Facility Safety (NFS) publishes the Operating Experience Weekly Summary to promote safety throughout the Department of Energy (DOE) complex by encouraging feedback of operating experience and encouraging the exchange of information among DOE nuclear facilities.

The Weekly Summary should be processed as an external source of lessons-learned information as described in DOE-STD-7501-96, *Development of DOE Lessons Learned Programs*.

To issue the Weekly Summary in a timely manner, the Office of Operating Experience Analysis and Feedback (OEAF) relies on preliminary information such as daily operations reports, notification reports, and, time permitting, conversations with cognizant facility or DOE field office staff. If you have additional pertinent information or identify inaccurate statements in the summary, please bring this to the attention of Jim Snell, 301-903-4094, or Internet address jim.snell@hq.doe.gov, so we may issue a correction.

Readers are cautioned that review of the Weekly Summary should not be a substitute for a thorough review of the interim and final occurrence reports.

Operating Experience Weekly Summary 97-30

July 18 through July 24, 1997

Table of Contents

EVENTS	1
1. CHEMICAL REACTION OVERPRESSURIZES DRUM	1
2. DESIGN DEFECT ON DUAL FILTER HOUSING	3
3. RADIATION MONITOR OPERABILITY CHECKED WITH WRONG SOURCE.....	4
4. INADVERTENT BATTERY CHARGE RESULTS IN TECHNICAL SPECIFICATION ACTION STATEMENT.....	6



Visit Our Web Site

The Weekly Summary is available, with word search capability, via the Internet at http://tis.eh.doe.gov/web/oeaf/oe_weekly/oe_weekly.html. If you have difficulty accessing the Weekly Summary at this URL, please contact the ES&H Info Center, 1-800-473-4375 for assistance.

EVENTS

1. CHEMICAL REACTION OVERPRESSURIZES DRUM

On July 17, 1997, at the Oak Ridge Y-12 Site, the manager for the Waste Management Facility reported an overpressurized drum event that occurred sometime between the evening of June 2 and the morning of June 3, 1997, in a Resource Conservation and Recovery Act (RCRA) storage area. A sealed, plastic-lined, 55-gallon drum, containing organic waste materials from the cleanup of a nitric acid spill, overpressurized and blew the lid off the drum. The force of the venting caused the lid to strike and bend an overhead fire protection system pipe and dislodge the pipe hangers. The contents of the drum were strewn about the storage area. Investigators determined that workers mixed incompatible materials (nitric acid and organics), resulting in a chemical reaction that overpressurized the drum. Incorrect mixing of chemicals has the potential to cause fire, explosions, and generation of toxic gas. Pressurized drums can present several personnel hazards, including (1) injury from an expelled drum lid or fragments of the burst drum; (2) exposure to radioactive or hazardous contents of the drum; or (3) exposure to pyrophoric materials, which can ignite and burn. (ORPS Report ORO-LMES-Y12WASTE-1997-0004)

On June 2, 1997, workers at the storage area discovered a leaking plastic-lined drum containing 50 percent waste nitric acid, radiological wastes, and metals. The drum had been in storage for 5 years. A crack developed in the liner allowing the acid to react with the metal drum. This produced a leak and resulted in a spill. The spill response coordinator for the facility had the workers clean up the spill. They pumped the liquid nitric acid waste into two separate containers. After cleaning up the spill, the workers placed their chemical-resistant protective clothing, rubber gloves, leather gloves, respirators and cartridges, plastic bags, paper towels, and diapers in a lined, 55-gallon drum. They sealed the drum and placed it in a room to await further disposition. Although the drum exhibited no evidence of pressurization at the end of the day, it overpressurized by the next morning.

On June 3, 1997, workers cleaned up the nitric-acid-contaminated cleanup materials strewn about the storage area and put them into two lined drums. They sealed these drums with a lid equipped with a vent-type bung plug.

Investigators determined that the workers were all trained in hazardous waste operations and RCRA. The site waste management spill team was not contacted to support the cleanup of the June 2 spill. The spill team would have neutralized the acid spill before the cleanup began. This would have prevented mixing the nitric-acid-soaked cleanup materials with other organic materials and the ensuing chemical reaction.

NFS reported pressurized drum events in Weekly Summaries 97-19, 97-03, 96-44, 96-42, 96-04, 95-50, 95-10, 95-25, 95-02, 94-48, 94-23, 94-13, and 94-08. NFS has also reported numerous chemical reaction events. The following events occurred in the past 2 months.

- On July 2, 1997, at the Lawrence Livermore National Laboratory, a building evacuation occurred because of fumes generated from the mixing of a solution of nitric acid, hydrogen fluoride, and acetic acid with a solution of ethanol, hydrofluoric acid, and water. Investigators determined that the fumes resulted from a chemical

reaction of incompatible materials being mixed for waste disposal by a technician. (ORPS Report SAN--LLNL-LLNL-1997-0037)

- On May 22, 1997, a waste shipping container at the Fernald Environmental Management Project overpressurized, ruptured, and was damaged by heat generated from an unexpected chemical reaction between uranium, water, and magnesium. (ORPS Report OH-FN-FDF-FEMP-1997-0034)
- On May 14, 1997, a tank exploded at the Hanford Plutonium Finishing Plant as a result of a chemical reaction between concentrated hydroxylamine nitrate and nitric acid. The top of the tank ruptured a small fire-protection water line during the explosion. (ORPS Report RL--PHMC-PFP-1997-0023)

These events highlight the need for managers of facilities that generate and receive chemical waste materials and of facilities that normally handle and store chemicals to develop appropriate programs and procedures to identify chemical compatibility. These programs should consider safe handling, storage, and transportation requirements. Facility managers should ensure that workers are familiar with facility safety precautions and emergency procedures and should provide workers with the necessary information to ensure accurate compatibility evaluations.

In June 1997, NFS issued DOE/EH-0557, Safety Notice 97-01, "Mixing and Storing Incompatible Chemicals." The notice contains lessons learned related to the mixing and storing of incompatible chemicals and references a list of chemical incompatibilities provided by the University of Michigan. A copy of the chemical incompatibility list is available on the Internet at URL <http://www.orcbs.msu.edu/chemical/chp/appendixc.html>. NFS also provides guidance in DOE/NS-0013, Safety Notice 93-01, "Fire, Explosion, and High Pressure Hazards Associated with Waste Drums and Containers," February 1993, that will help facility personnel who handle and store drums and containers of hazardous materials. Safety Notices 97-01 and 93-01 can be obtained by contacting the Info Center, (301) 903-0449, or by writing to ES&H Information Center, U.S. Department of Energy, EH-72/Suite 100, CXXI/3, Germantown, MD 20874. Safety Notices are also available on the Operating Experience Analysis and Feedback Home Page at http://tis.eh.doe.gov:80/web/oeaf/lessons_learned/ons/ons.html.

The Office of Environment, Safety and Health provided information about the hazards associated with mixing of incompatible chemicals in DOE/EH-0296, Bulletin 93-2, "Mixing of Incompatible Chemicals," February 1993. DOE Defense Programs Safety Information Letters, SIL 96-05, *Compatibility Considerations in the Mixing of Waste Chemicals*, November 1996, and SIL 96-01, *Incidents from Chemical Reactions due to Lack of or Failure to Follow Proper Handling Procedures*, June 1996, address these issues and provide guidance to prevent these incidents.

KEYWORDS: chemical reaction, pressurized drum, waste, chemical spill, acid

FUNCTIONAL AREAS: Chemistry, Industrial Safety, Materials Handling and Storage

2. DESIGN DEFECT ON DUAL FILTER HOUSING

On July 18, 1997, personnel at the Argonne National Laboratory East filed an update on a May 7, 1997, occurrence in which maintenance technicians discovered higher-than-expected contamination levels while performing periodic maintenance on an atmosphere-controlled glovebox ventilation system. Investigators traced the problem to a design defect on a dual High Efficiency Particulate Air (HEPA) filter housing. This defect allowed some of the flow to bypass the filter and deposit radioactivity downstream of the filter. The safety analysis report identifies this filter as a mitigating system, and the discovery was evaluated as an unreviewed safety question. The facility manager curtailed operations in the glovebox until an investigation was completed. No release to the building or environment occurred because the filter is part of the atmosphere regeneration and re-circulation system. However, similar design defects, if incorporated into exhaust filter housings, could result in releases of radionuclides to work areas or the environment. (ORPS Report CH-AA-ANLE-ANLEER-1997-0003)

Investigators found that insufficient detail in the drawing of the dual HEPA filter housing resulted in a tolerance error on the thickness of a part of the housing. This defect allowed each of the filters to seal on three of the four sides, but left a gap on the remaining side. Contaminated air bypassed the filters on the unsealed side and contaminated the piping and purification system to higher-than-expected levels. Investigators determined the filter housing was designed in 1986 for a different glovebox, and reviewers did not find the flaw during their design review. Investigators also determined the glovebox designers did not review the original design further when they used it in the current system. Cognizant facility personnel determined that an unreviewed safety question existed because the design flaw created the possibility of accident consequences outside, but not exceeding, the design basis. The personnel responsible for the safety analysis report reviewed the scenario and determined that it had smaller consequences than the design basis accident (an earthquake resulting in a fire).

Corrective actions include installing of inserts into the existing filter chambers to seal against further leakage and including provisions for testing filters in-place for all new glovebox designs.

NFS reported events about leakage around filters or from a filter plenum in Weekly Summaries 96-15, 93-44, 93-26, and 92-26.

- On April 4, 1996, technical support supervisors and senior managers at Rocky Flats determined that an out-of-tolerance condition had existed in three buildings since 1993 because of inadequate requirements for seal-testing the ventilation plenum exhaust door. The contractor reported no detectable leakage around the door when the actual leakage was as much as 0.05 percent. (ORPS Report RFO-KHLL-779OPS-1996-0031)
- On October 16, 1992, personnel at the Lawrence Livermore National Laboratory discovered cracks in the welds of the duct work that services fume hoods, leading to a possibility of bypass leakage. Similar problems were discovered at the New Brunswick Laboratory in November 1992; at Savannah River HB-Line on June 26, 1993; and at Oak Ridge National Laboratory on October 25, 1993. (ORPS Reports SAN--LLNL-LLNL-1992-0098, CH--NBL-NBL-1992-0002, SR--WSRC-HBLINE-1993-0016, and ORO--MMES-X10CHEMTEC-1993-0016)

NFS published Safety Notice 94-02, "High-Efficiency Particulate Air Filters," August 1994, to address the specification, purchase, and application of HEPA filters in safety-related applications. The notice provides a list of standards and directives associated with HEPA filters. Safety Notices can be obtained by contacting the Info Center, (301) 903-0449, or by writing to ES&H Information Center, U.S. Department of Energy, EH-72/ Suite 100, CXXI/3, Germantown, MD 20874. Safety notices are also available on the Operating Experience Analysis and Feedback Home Page at http://tis.eh.doe.gov:80/web/oeaf/lessons_learned/ons/ons.html. ANSI N 510, *Testing of Nuclear Air Cleaning Systems*, addresses bypass leakage testing. ASME N 509-89, *Nuclear Power Plant Air-Cleaning Units and Components*, section 4.14.2, provides guidance on determination of allowable leakage and introduces "non-mandatory Appendix B," which provides additional leakage criteria. DOE O 420.1, *Facility Safety*, section 4.1.1.2, addresses design requirements for non-reactor nuclear facilities to prevent or mitigate the release of radioactive materials to the environment. In addition, the American Glovebox Society has published *Guideline for Gloveboxes*, AGS-1994-G001, which sets design standards for glovebox filter systems in Section 5.6.2. This standard may be ordered from the Society at P. O. Box 9099, Santa Rosa, CA 95405-1099; by calling 1-800-530-1022; or by sending e-mail to AGSHQ@AOL.COM. The Society also provides glovebox information on their home page at <http://www.esper.com/ags/>.

KEYWORDS: glovebox, HEPA filter

FUNCTIONAL AREAS: Design, Configuration Control

3. RADIATION MONITOR OPERABILITY CHECKED WITH WRONG SOURCE

On July 17, 1997, at the Savannah River Site, a radiological control operations inspector used the wrong source to test the operability of a replacement Victoreen® Area Monitor Packet (VAMP). Electrical and instrumentation technicians had replaced a failed VAMP in the F-Tank Farm with one from the H-Tank Farm. A maintenance manager discovered that the source sticker on the replacement VAMP did not match the source used to perform the source check. The procedure for the VAMP source check requires performing a source check using a designated specific source indicated by a number on the sticker attached to the VAMP. The specific source would be the source used to calibrate the VAMP. Using the wrong source to verify operability of the radiation monitor could have resulted in an instrument response that was different than the response observed when the monitor was calibrated. (ORPS Report SR--WSRC-FTANK-1997-0011)

Work planners prepared a work package to replace the failed VAMP. The work package referenced the procedure for the VAMP source check as the post-maintenance test, but did not specifically address the requirement for a specific source by using a signoff with quality assurance hold points. The replacement VAMP came from the H-Tank Farm because there were no spare VAMPS available in the F-Tank Farm. The maintenance supervisor, who knew the VAMP was from H-Tank Farm, did not communicate that information to the radiological control operations inspector who performed the source check. Maintenance personnel submitted the completed work package to Operations. Operations personnel accepted the completed work package without noticing the source-check error.

The facility manager declared the VAMP inoperable, and technicians replaced it with a correctly source-checked VAMP. The facility manager also had technicians check all F-Tank Farm VAMPS to ensure they had the proper source stickers. Maintenance personnel will prepare a revision to the maintenance instructions that will require signoffs for checking the correct source and a quality assurance verification.

Operating Experience Analysis and Feedback engineers reviewed the Occurrence Reporting and Processing System database and found several similar events. The following are two examples.

- On November 15, 1994, engineering personnel at the Savannah River Site determined that the calibrations for a ventilation system interlock, designed to maintain negative pressure within a controlled cabinet, were outside of the specified tolerance. Engineering personnel reviewed the data and determined that the condition was caused by technicians using the wrong instrument for the range and equipment being calibrated. (ORPS Report SR--WSRC-FBLINE-1994-0058)
- On April 24, 1991, at Hanford, an alarm set point for liquid effluents was 12 percent higher than the maintenance procedure called for because maintenance personnel used a calibration source other than the one specified in the procedure. (ORPS Report RL--WHC-PUREX-1991-1006)

This event illustrates the importance of ensuring that equipment from one facility is properly calibrated and checked for operation before it is used in another facility. Equipment calibrated and tested at one facility may not meet the requirements of another facility unless the same instruments are used to verify its operability. Technicians performing post-maintenance or operability testing on radiation monitoring equipment should check calibration and source-check stickers to ensure the correct sources are used. Personnel at DOE facilities should review their administrative processes to ensure that programs are available to control the substitution or replacement of equipment that is important to safety. The potential consequences of not having such programs include undetected inoperability of safety-related systems and subsequent failure during accident conditions.

KEYWORDS: radiation monitoring, test, source, calibration

FUNCTIONAL AREAS: Instrumentation and Control, Radiation Protection

4. INADVERTENT BATTERY CHARGE RESULTS IN TECHNICAL SPECIFICATION ACTION STATEMENT

On July 15, 1997, at the Idaho National Engineering Laboratory, an electrician inadvertently placed the Advanced Test Reactor in-service plant protective system battery bank on an equalize charge instead of a float charge. This caused battery bank voltage to increase above limits, resulting in a technical specification action statement. The action statement required plant personnel to return the battery to a float charge and to total terminal voltage, within limits, within 8 hours or manually scram the reactor. The electrician thought he was charging a bank of spare batteries. The Advanced Test Reactor technical specifications require the plant protective system batteries to be on float charge rather than equalize charge during reactor operation. The shift supervisor directed the plant foreman and electrician to reset the battery charger timer to zero, and the plant protective system battery bank voltage decreased to normal. This event is significant because the electrician's inattention to detail resulted in the entry of an action statement that could have affected reactor operation. (ORPS Report ID--LITC-ATR-1997-0014)

The electrician discovered the pilot cell voltage was 0.2 volts lower than a previous reading while performing voltage readings on a bank of spare batteries for the plant protective system. He assumed that the 24-hour timer on the battery charger had timed-out and the spare batteries were no longer being charged. Engineers made a recent plant modification that removed the spare battery from the in-service battery charger and placed it on a separate charger. The electrician inadvertently proceeded to the battery charger for the in-service plant protective system battery bank and reset the charger timer to 24 hours. This placed the batteries on equalize charge while they were supplying power to plant protective system room electronics. The equalize charge

raised the battery bank voltage above the technical specification limit. An equalize charge is used when a difference exists between the potentials of the cells in a battery. The charge is applied to bring the cells with a lower voltage up to an equal potential to the other cells.

An operator performing routine surveillance checks discovered that the bank voltage for the in-service plant protective system battery bank was at 37.3 volts. This was outside of the allowable technical specification range of 34 to 36 volts. He also observed that the battery charger was on equalize charge and notified the shift supervisor. The shift supervisor immediately recognized that the increased voltage resulted in a technical specification action statement.

Investigators determined that the Advanced Test Reactor was in the technical specification action statement for a total of 8 minutes. They also determined the plant foreman and electrician used an analog meter and a calibrated digital meter to verify that the plant protective system battery bank voltage was back within specification. Investigators determined that the electrician was not thinking and looked at the wrong battery charger when he started the equalize charge. They determined the electrician followed a procedure for battery test discharge and equalize charge, but it did not require him to contact a supervisor or the control room when changing equipment status.

This event underscores the importance of attention to detail and self-checking. NFS advocates self-checking, a risk management tool designed to reduce the potential for human error. Self-checking requires distinct thoughts and actions that focus attention at a specific moment before performing a task. DOE/EH-0502, Safety Notice 95-02, "Independent Verification and Self-Checking," describes a technique that requires workers to (1) stop before performing the task to eliminate distractions and identify the correct component; (2) think about the task, expected response, and actions required if that response does not occur; (3) reconfirm the correct component and perform the function; and (4) review by comparing the actual versus the expected response. Safety Notice 95-02 can be obtained by contacting the Info Center, (301) 903-0449, or by writing to ES&H Information Center, U.S. Department of Energy, EH-74, Suite 100, Century XXI, Third Floor, Germantown, MD 20874. The Safety Notice is also available by accessing the Operating Experience Analysis and Feedback Home Page at http://tis.eh.doe.gov:80/web/oeaf/lessons_learned/ons/ons.html.

DOE-HDBK-1084-95, *Primer on Lead-Acid Storage Batteries*, provides information on the operation, construction, and maintenance of lead-acid batteries. The handbook also provides information on the hazards associated with storage batteries and recommended precautions. Information on battery chargers and charging operations is provided in the maintenance section.

Personnel should report any deficiencies in equipment performance and any status changes to control authorities. DOE O 5480.19, *Conduct of Operations Requirements for DOE Facilities*, chapter VIII, "Control of Equipment and System Status," states that the operations supervisor is responsible for maintaining proper configuration and should authorize status changes to major equipment or systems. Changes in the status of facility equipment and systems should be reported to the governing stations or to the individual who authorized the change. Changes in the status of safety-related equipment and systems should be authorized by the supervisor and reported to the control area.

KEYWORDS: inattention to detail, self-checking, battery charger

FUNCTIONAL AREAS: Operations, Licensing/Compliance